

PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 682-1513-1	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/IL 03/00621	International filing date (day/month/year) 27.07.2003	Priority date (day/month/year) 25.07.2002
International Patent Classification (IPC) or both national classification and IPC A61L2/10		
Applicant ATLANTIUM LASERS LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.
 - This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:
 - I Basis of the opinion
 - II Priority
 - III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV Lack of unity of invention
 - V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI Certain documents cited
 - VII Certain defects in the international application
 - VIII Certain observations on the international application

Date of submission of the demand 25.02.2004	Date of completion of this report 03.11.2004
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I. Basis of the report

1. With regard to the elements of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70, 16 and 70, 17)*):

Description, Pages

1-54 as originally filed

Claims, Numbers

1-15 filed with telefax on 19.08.2004

Drawings, Sheets

15-55 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:
- the drawings, sheets:

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5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

the entire international application,

claims Nos. 1-13(part)

because:

the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (specify):

the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

no international search report has been established for the said claims Nos. 1-13(part)

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

the written form has not been furnished or does not comply with the Standard.

the computer readable form has not been furnished or does not comply with the Standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N) Yes: Claims 1-15
No: Claims

Inventive step (IS) Yes: Claims 1-15
No: Claims

Industrial applicability (IA) Yes: Claims 1-15
No: Claims

2. Citations and explanations

see separate sheet

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Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. Claims 1-13 relate to a "method for photochemical treatment of a target site". According to the present application, said target site includes the human, mammal or animal body (see p. 6, 3th par., p. 8, 2nd and 3th par., p. 16, 1st par., p. 21, 2nd par.-p. 22, 1st par., p. 23, 1st par., p. 26, 4th par., p. 27, 1st and 2nd par., p. 29, 2nd par., p. 30, 1st par., p. 40, last par., p. 41, last par., p. 48 and 49, claim 4). In particular, it is specified that the claimed method can be used in surgery, therapy and diagnostic for *in vivo* applications. Such *in vivo* applications of the claimed method were excluded from the international search according to Rule 39.1(iv) in combination with Article 17(2)(a)(I) PCT. According to Rule 66.1(e) PCT, these applications of method claims 1-13 have therefore not been the subject of the international examination and they are hence excluded from the present report (Rule 70.2(d) PCT).

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- 1.1 The present application relates to a method and a device for effecting a photochemical treatment of a target site. In particular, the method as defined in independent claim 1 comprises the steps of directing a liquid stream towards a target site, the stream being free-space flowing along at least a part of its trajectory; directing an UV radiation within said liquid stream so that the liquid serves as a wave guide carrying said UV radiation locked within the liquid due to total internal reflection, and maintaining the obtained liquid stream in contact with a target site in order to achieve the disinfection, sterilization, decontamination or detoxification of said target site.
- 1.2 The most relevant state of the art is represented by documents US-A-3264055 (D1) and WO-A-0032520 (D2). Both D1 and D2 disclose (cf. passages cited in the search report) the treatment of a liquid with an UV radiation and the subsequent use of such treated liquid. Both documents however, fail to disclose the introduction of an UV radiation within a free-space flowing liquid stream directed to a target site. Particularly D1 describes the exposure of a liquid stream to an UV radiation with the aim of sterilizing said liquid, which is then used as coolant or

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lubricant. In D2 water is treated with UV radiation in order to activate the dissolved oxygen. Such "activated" water is then used for disinfection purposes. No liquid stream directed to a target is described. The subject-matter of independent claim 1 is hence novel (Article 33(2) PCT).

1.3 Document US-A-4749126 (D5) disclose the introduction of an UV radiation within a free-space flowing liquid stream (cf. passages cited in the search report). The produced liquid stream however, is not directed to a target to achieve its photochemical treatment. In D5, the produced liquid jet is used for providing lighting effects, i.e. for the illumination of water fountains.

Since no indication is provided in the available prior art that the introduction of UV radiation may be provided to produce a decontaminating liquid stream, the subject-matter of claim 1 is also regarded as to involve an inventive step over the available state of the art (Article 33(3) PCT).

2.1 Independent claim 14 defines a device for directing a liquid stream carrying an UV radiation to a target site. The device comprises a pipe-like member having a liquid inlet and a liquid projection outlet. A light radiation inlet is provided for introducing a light beam into the liquid flow so that the radiation remains locked within the free-space liquid jet stream projected from said liquid outlet towards a target site. The most relevant state of the art is represented by document D5, which discloses a device for the introduction of an UV radiation within a free-space flowing liquid stream (cf. passages cited in the search report).

2.2 The subject-matter of claim 14 differs from the device of D5 in that means are provided for effecting a venturi hydrodynamic-pneumatic differential pressure between the liquid path and the light inlet. Due to such differential pressure, air is sucked through said light inlet and it mixes with the flowing liquid. In this way, the light diffusion within the jet is increased (see p. 52, 2nd par.). Since no indication is provided either in D5 or in the remaining available prior art that means could be provided to produce the mentioned air-suction operation, the subject-matter of claim 14 is regarded as to be novel and to involve an inventive step over the available state of the art (Article 33(2) and (3) PCT).

3. Dependent claims 2-13 and 15 concern particular embodiments of the subject-matter of independent claims 1 and 14, respectively, and therefore, they fulfil the requirements of Article 33(2) and (3) PCT.

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4. The subject-matter of all claims is regarded as to be industrially applicable (Article 33(4) PCT).

CLAIMS:

1. A method for affecting at least one chemical or mechanical property of a target site, the method comprising;
 - (a) providing a stream of liquid having a predetermined flow rate towards a contact with the target site;
 - (b) providing UV-radiation having predetermined parameters in terms of power, wavelength, duty cycle and repetition rate;
 - (c) directing said UV-radiation within said stream of liquid along a trajectory of said stream;
 - (d) maintaining said stream in contact with said target site for a time period and under conditions sufficient for affecting said at least one chemical or mechanical property.
2. The method of Claim 1, wherein the liquid stream is free-space flowing along at least one portion of its trajectory.
3. The method of Claim 1, wherein the target site is an item or a substance suspected as afflicted by noxious biological or chemical species.
4. The method of Claim 1, wherein the target site is selected from pre-filled containers, filled containers, surfaces, humans, mammals, vehicles, medical instrumentation, conveyors, conveyor belts, foods, fruits, vegetables, salads.
5. The method of Claim 1, wherein said UV-radiation is generated by a laser source.
6. The method of Claim 5, wherein said laser source is a high-frequency pulsed laser.
7. The method of Claim 5 or 6, wherein said laser source is a high-intensity pulsed laser.
8. The method of any one of Claims 5 to 7, wherein said laser source is a pulsed 266nm laser.
9. The method of any one of Claims 5 to 7, wherein said laser source is a pulsed 355nm laser.

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10. The method of any one of Claim 5 to 9, wherein said laser source is a high intensity sub-microsecond pulsed laser.
11. The method of Claim 1, wherein the at least one chemical or mechanical change applies to at least 50 percent of particle type or microorganism species predetermined as a subject for having the change.
12. The method of Claim 1, wherein said UV radiation carried by the stream of liquid performs disinfection of said liquid on its way to the target site.
13. The method of Claim 1, further comprising recycling the liquid by gathering it from the vicinity of the target site and returning it towards another contact with a target site.
14. The method of Claim 1, further comprising recycling the liquid by gathering it from the vicinity of the target site and returning it towards another contact with a target site, wherein the liquid is disinfected on its way to the target site by means of the UV-radiation carried by the liquid stream.
15. The method of Claim 1, comprising: coupling output from at least one UV-radiation unit to an inlet of a water projecting means and feeding the liquid stream into said water projection means under venturi pressure.
16. A device for supplying a liquid stream carrying UV-radiation to a target site, the device comprising at least one pipe-like member having an inlet means for receiving the stream of liquid and the UV radiation under venturi pressure, and an outlet means for outputting said liquid stream carrying the UV radiation.
17. The device of Claim 16, wherein said inlet means comprises a first inlet opening for receiving a beam of UV radiation; and a second inlet opening for receiving the liquid stream.
18. The device of Claim 16, comprising a UV radiation source operable to generate at least one beam of UV radiation, a beam splitting assembly accommodated in the optical path of the generated UV radiation and operable to split the generated UV radiation beam into an array of UV components; an array of the pipe-like members each associated with the corresponding one of the UV components.